>> Good morning, everybody.
I guess it's almost midday.
Those people on the webcast I guess it's good morning, good afternoon and good evening depending where in the world you're watching us from.
This is a live webcast and we know we have a lot of folks from around the world tuning in to hear this thing.
Welcome.
See a lot of great faces but you didn't get the memo about jacket and tie.
[LAUGHTER]
Oh, well, we have a great program for you today and I know you've all seen that.
Seven months ago we were in the desert, a lot of us, for the Grand Challenge and everybody was asking what next.
Today is the first chapter of what next.
What we'd like to do is introduce Dr. Tony Tether, many of you know him, the director of DARPA and he pretty much is the brain child behind the Grand Challenge series and leading to the Urban Challenge.
It's brought a community of people together.
Without further adieu I would like to welcome Dr. Tony Tether to the stage, please.
[APPLAUSE]
>> Welcome back.
It doesn't seem like it was that long ago, actually.
I see a lot of familiar faces here.
We had a hard time actually trying to decide what to do next for the next Grand Challenge.
And the obvious case was to now that everybody could travel through the desert, is to move it to the cities.
Because in order for these vehicles to really be -- to do what we want them to do, while there will be long stretches like you had last time in the desert, eventually you will have to go through a city.
And that was actually easy to think up.
Now the question is how do you do that?
That really took us a long length of time.
So I'm going to just for a little bit of highlights of that.
You'll hear a lot of the details after me on the rules, what to expect.
We'll as always try not to change them too often.
[LAUGHTER]
We think we have them all down now.
This is our third try.
But the chief judge, you can never count on him to go along with anything.
Next slide.

This is DARPA.
I think you all know that.
Next slide.

Well, as you know we've had these three challenges.
One was the Barstow, where we really learned about how hard this really was and quite frankly I still believe that was a great success even though the distance would not show it.
But it was -- to have a vehicle go by itself that distance was a great success and we learned about things like the desert tortoise and a few other things.
Then, of course, the last one you all were at, 132 miles, 10 hours, $2 million with a great success there and here we go for the third.
The Urban Challenge.
Which will be on November 3, 2007?
Why then?

It's 18 months from now and that seems to be what it takes for everybody to get going and get their teams going and we didn't -- I'll mention earlier, but that's how we picked that date.
Roughly be 60 miles.
Six hours.
This time we are proposing three prize levels.
A first prize of $2 million, a second price of $500,000 and the third prize of $250,000.
Why are we doing the second and third prize this time when we didn't do it before?
I want to make sure there is an interest there.
I want to make sure that somebody doesn't feel there is somebody who is such a frontrunner.
I don't know who that frontrunner is, that there is no need to be out there trying.
And so by having these other two levels, we're hoping to keep the momentum going.
Next slide.

I don't know, this is an old slide.
This is as of at least Friday, I guess, right?
We have people here from 29 states.
I'm sure we have more than that as Ron said, I don't know on the webcast where people are.
But there is quite a few of you here from all over the country, which is really gratifying.
And next slide.

Now, why again?
Well, you know, before we were looking at basically city to city kind of driving.
The distances that we picked were the typical distances that you would find in a place like Baghdad, as convoys would travel between major cities.
And as difficult as that was, that really is still not where we have to be.
Next slide.

Because we have to now sooner or later go through Baghdad itself.
And going through Baghdad itself is a city.
This kind of gives you a feeling of how one might make its way through Baghdad through traffic.
It is 60 miles.
That's where the number came up with.
And again about six hours again because that's about -- you know, you have to do it in less than that in order for this to really be tactically interesting.
Just trying to give you some motivation for these numbers.
You know, they'll probably -- no need to do that ever again but just so you understand, we just didn't pick it out of the air.
We tried to have some rationale for what they were.
Next slide.

You'll have to obey traffic laws, safe entry into traffic flow, safe passage through busy intersections, safe following of passenger moving vehicles, safe passage of a stopped vehicle.
If you thought passing somebody out in the desert last time was scary, this is just one part of what you'll have to do here.
Finding an alternative route if the primary one happens to be blocked.

And a safe U-turn because you might want to turn around and go back from where you came.

These are all the things that your vehicles are going to have to do.

You'll have to demonstrate that you can do it to get to the main event and then in the main event, we will simulate this activity to the extent that we can.

There will be clutter, there will be moving vehicles, there will be professional drivers driving those moving vehicles.

We will make sure that each vehicle experiences the same experience to the extent that we can.

In other words, your vehicle doesn't experience some traffic that another vehicle did not.

So we're going to -- it is going to make it coordination on our part a lot harder.

But we will do what we can.

Next slide.

OK.

You probably have noticed that we have two tracks.

The first track is really kind of a normal DARPA one.

The first track is we let contracts with a broad agency announcement saying hey, we want to have a vehicle to come and do exactly what I just talked about.

And people put in a proposal.

These are not lengthy proposals.

They really are -- this process is meant to be friendly, you know, and so forth and so on.

We will evaluate those proposals.

You really are not so much evaluated against each other.

You aren't evaluated against each other but you basically try to evaluate the person with the best proposal for achieving the ultimate objective of getting to the finals and doing six hours, 60 miles in less than six hours.

The difference here is that we're going to pay up to $1 million in technology development to the people in track A.

The program does -- now, this program will have all the regular stages.

It will have an event QE that you have to go through in order to get to the main event.

The program actually ends at the end QE, the qualifying event.

It is possible that just because you're in this track that you don't get to go to the main event.

In other words, you can flunk the NQE and not get to go to the main event.

So vehicles even on track A still have to pass all of the gates.

Track B is more the normal one that you've been used to in the past.

Here you submit an application, you send a video, you get selected for a DARPA site visit.

Those of you who have had those before you know what those are like.

Now, this site visit will be different than the last one.

We'll have a very tough site visit.

Very, very tough to get through this site visit.

The reason is, is that if you get through it, you get to participate in the national qualifying event and we are proposing to pay whoever shows up at the NQE $50,000.

If you get through the NQE which again you can with the track A and make it to the main event, you're given another $100,000 to participate in the final event, which would be the three prizes.

So this really -- I mean, hopefully as we go through it the rest of the day this will become clearer.

This is really straight forward.

Not complicated your most complicated thing is trying to decide which way to go, quite frankly.
Next slide.

OK.
Now, the DARPA prize authority.
This is the way it states in the legislation.
Actually the prize authority is not given to DARPA.
The prize authority is really always given to the Secretary of Defense.
And this is the way the bill reads.
If the Secretary of Defense may carry out a program but it also says the Secretary of Defense acting through the director of the advanced research project agency may carry out the plan.
It is Rumsfeld that Congress gives him this short authority but then he's told how to carry it out.
Now, what happened is that it expired -- is expiring on September 30th.
We could have made the event in September to comply with where we are.
Retrospect maybe we should have done that.
But we didn't so we went for new legislation to kind of extend this past the end of FY 2007 and it caused a few problems.
Here is the situation.
Well, the house Armed Services Committee, as you go through this for those familiar with it, there are two houses and they both authorize and they finally get together and come up with a conference bill.
The health armed services bill did what was asked.
They extended the DARPA.
The house voted on that and approved the bill.
However, on the Senate side the Senate has not, in the putting together of the bill, basically removed DARPA.
So DARPA does not have a prize authority on the Senate side.
Now, let me tell you this bill is not official yet.
The Senate hasn't voted on it and they won't vote on it until July and then, because there is a difference even if this came through the way it is, there is a difference in the bill in conference so forth and so on.
And so we don't really know what the output of that is going to be.
We have the next slide.

Here it is today, again, where is it today?
The Secretary of Defense acting through the director of the DARPA, has been changed.
They now have given authority once again to the secretary of defense but now have told him if he wants to carry out this authority he can only act through the director of the defense research and the service acquisition executives and military departments.
Now, this causes some problems, right?
I mean, the problems are that if this were the past we would no longer be able to give the prize.
And, in fact, the Secretary of Defense couldn't even say wait a minute.
I want those guys in DARPA to do that because it's clear that the will of Congress said no.
So we are in a funny situation here.
Now, when you get into these situations, the only thing, quite frankly, you can do is look at the absolutely worst case.
What is the worst that can happen if the language ends up being exactly as the Senate staff have proposed it?
Remember, we still haven't gotten a vote by any Senator on this yet.
Next slide.

Well, we're still going to have an Urban Challenge.
That doesn't go away.
We're still going to have this Urban Challenge.
The problem is, we're not going to have any prize money.
So if the worst case is that we still have the Urban Challenge but we don't have any prize money.
Instead of prize money we'll give you trophies.
[LAUGHTER]
I promise -- I promise that the trophies will be given because I'll personally buy them myself.
Because I don't have to have anybody authorize that except for my wife.
She said it was OK.
So I can guarantee you the trophies.
Now remember, this is at the beginning of a process but any of you who can't stand this being the outcome, and this is why I'm making a big deal about it especially for the track B part, any of you who can't stand this being the outcome should enter into this very carefully because this is Washington and logic does not prevail although we're outside the beltway today and it tends to here but it's hard -- by the way, this only happened in the last week.
I had not had anybody explain to me why they did it.
I've not been able to find out why they did it.
There is no language that usually goes along with this and says they're clearly mad at somebody.
I mean, there is no way hiding that.
I asked Ron, I said, what have you been doing?
[LAUGHTER]
And he said he hasn't been doing anything.
So I know I really don't know why.
Normally with something like this they let us know.
They knew we were going to be here today because the announcement has been out for quite a while.
I don't know.
I thought it was a mistake.
I thought our legislative guy.
I said they made a mistake.
What they meant to say was that in addition to the director of DARPA these other guys can -- the secretary can act through them, too, which seemed to be the more logical thing to have done but apparently -- I still think it might be just a simple mistake.
We'll find out.
If it's a mistake by July 4 that's great.
I'm done.
I'll be around for questions later on.
I really welcome you, glad to see you all again and remember, we'll have some questions and see you along the way and if not here we'll see you at the undisclosed city in the western part of the United States.
Oh, yeah, I'm not really sure if Ron isn't the reason.
So just in case, as you know Jose was the first program manager, the first Grand Challenge.
Ron is the program manager of the second Grand Challenge.
Ron is still my Chief of Staff doing a thousand other things.
We have a new program manager Norm Whitaker.
You'll see him in a little bit.
Stand up.
[APPLAUSE]
Norm will be the program manager and get you through this.
[APPLAUSE]

>> Can you put the agenda back up again?
Just to talk through the few things.
I'll cover through the Grand Challenge 2005 and tell you a couple of inside
stories that maybe you weren't aware of before where I did have dark hair before
it's started and it's now gray.
We're watching Norm's hair.
Then we'll show the contracting process, give you a brief on the proposals
particularly for the track A and then we have a period for questions.
So what I would like to recommend is that probably hold some questions until the
break and then to the question area and then we'll answer all your questions.
Hard to believe we're making history.
Next slide, next slide.

There.
That's where it all started.
195 applicants.
Almost two years ago in August we gathered on the west coast for the
participants' conference.
We didn't expect we'd have that many applications applying for the Grand
Challenge 2005.
We had to have a bid.
Other teams had to submit a video and we would do a site visit.
Out of 195 we got 140 videos which is absolutely incredible.
Next slide.

That moved them off to the site visits.
We looked at the videos and selected nearly 120 teams for site visits.
A lot of you when we looked at the comments later on were very impressed with
the site visits.
You don't realize we are not professional site visit teams so we brought the
program managers out two months before and trained them and I think you'll see
the results.
The point we tried to make to them--"Don't go near the vehicle when it's moving
down the road." And we just looked at the film the other day and sure enough
there is one of our ambitious program managers neck and neck with a robotic
vehicle running down.
But it was a terrific -- we found it to be a terrific milestone to determine the
capabilities of team.
I think you felt it was fair.
We'll do the same thing again and Norm will talk about those details later on.
On site visit we chose 43 semifinalists.
We picked alternates that surprised everybody.
One team went to the final.
That worked out OK.
As you can see what surprised us when we looked at this chart is that it was
equally divided between the western part of the country and the eastern part of
the country.
There is no dominance at all in any part of the country about building the
systems.
Next chart, please.

Then we went off to the National Qualification Event.
That name is not the right name.
It's not the California Speedway, it's the California wind way for people who
were there.
For the first couple of days we had 20 or 30 knots of wind.
Dust blowing off the mountains and into our eyes and the whole bit.

What you don't know is that we set it up to open the thing up I think it was at 10:00 in the morning and we had spent hours getting everything organized.
We knew we were on track ready to go and we put the team names in front of the garages.
How many of you know we put the wrong names in front of the garages?
At the last second five minutes prior to opening the gates we raced around with all the trucks and moved things around.
You thought DARPA is playing tricks again changing garages.
We raced around and did that.
Next chart.

Some of you remember that.
I think some of you did this.
A few of you that did it in 2004.
We honestly thought this -- nobody could do that twice in a row.
It was exactly that.
They did this seven days before the national qualifying event.
Congratulations to those teams.
Next chart, please.

That's what we set up as a track.
We picked that as we said before, to mimic some of the conditions that you would eventually see on the course and we changed it from 2.2 miles to 2.6 miles depending upon the event.
We mentioned earlier that given the first National Qualification Event, in the first Grand Challenge some vehicles had a hard time getting out of the chutes.
When you stood on the track and we're tired and you're tired as well.
The first one out, Mojavaton, completed it and completed it with a couple of minor infractions.
We knew at that moment we had a race on our hands.
And the next few days we continued and we had -- the lower left-hand side we had these two.
We were wondering if term X was going to give it a lift at times.
We also introduced something knew.
We took away GPS.
That will be key to the next race with the tunnel and tested it ourselves and sure it knocked it all out.
Next chart.

Here were the people.
The National Qualification Event was a tremendous accomplishment to all the teams that participated and in particular these teams to able to make it once around the track and in some cases a lot more and they came from around the country.
No one owned the rights.
Next chart, please.

Garden spot of Nevada.
We drive there 6:40 in the morning.
The night prior we had the barbecue party and as we get up in the morning 4:00 in the morning handing out the disks.
Nobody really slept.
Next chart, please.

I want to tell you something.
See the fellow on the phone at 6:40 in the morning.
The first call I get from the command post.

There are 12 loose cattle on the route and we don't know where they're at.
[LAUGHTER]
Now, this is where I also discovered that female cattle can have horns.
So everybody looked and said what do you want to do?
Let's try to get them and recover.
We had people on horseback and land rovers out there and recovered those things in two hours.
That was the first call we got in the morning.
Next chart.

That was the route.
It's easy to look at this chart now but it took us months to get this route together.
I had three flats putting this course together and there were a couple of scary moments.
Thursday night, I'm in the truck alone, getting to be 5:30 and 6:00 and you get a light on the dashboard and you're losing air in the middle of the desert.
I had three flats on that route.
We had a number of challenges.
Each one represented different things.
Even on the lake beds where you couldn't use your sensors very much.
Obstacles in the lower right where Dr. Tether worries that's the power lines of Los Angeles.
Somebody hits those and knocks them out we're in big trouble.
[LAUGHTER]
I was thinking where are we going?
We were on our way to South America.
Howard worked a lot on the route in helping get it ready went back and took a picture.
One vehicle, a very large vehicle, passed within one foot of one of these poles.
One foot.
But that was part of the philosophy we had for the event.
Dr. Tether was clear about it, we were going to let the vehicles go.
We realized the obstacles were out there and not be overly cautious.
Everyone got a fair shot and in particular getting close to the poles where a lot of guys said my heart is racing like crazy, 10 feet to the pole.
Do I hit the switch and they let it go.
Everybody had a fair shot.
In that case it was one foot.
The other thing about this route inside stories that you may not know we were out working in this area because we had problems with tortoises in California.
Low and behold lies a piece of land to make an airport and they shut us off.
They bought a big section in the middle and we had to negotiate to open that up again.
The other thing that scared us and many of you were out there and saw it were the rains.
Unbelievable how water can collect and we were lucky.
We were able to hold the event in between drenching rains two weeks prior and drenching rains that occurred a week and a half after.
Next chart.

That's the one that got us all nervous.
Mile 123.
Narrow road with a cliff.
We drove it a number of times testing route and we would drive down as human drivers and we would inch our way down pieces of this road because it was a sheer drop off to the left.

And all the guys we talked to in following the robotics didn't care.
They just went right down.
It was great.
Talk about professional drivers.
They weren't going to be outdone by a machine.
They went down.
We also had many discussions, OK, if a vehicle goes over what do we do to
recover it?
How do we get it out?
Worry about fires?
It proved to be challenging and very rewarding to see the video get through.
Some of you may have not seen this video about the Grand Challenge experience
itself and I think it captures all of the key moments.
Run the video.
>> We have the 23 finalists here.
It is going to be a very interesting, very challenging route.
All of you are winners.
This is not going to be easy.
It is here to prove that autonomous vehicles will be part of the military
inventory by a total of 30%.
Ladies and Gentlemen, highlander.
And we have movement from Stanley, Ladies and Gentlemen.
[APPLAUSE]
>> Block number 19, red team sandstorm.
Ladies and Gentlemen on the ground, challenger.
Ladies and Gentlemen, PARAMED.
>> That's what it's all about.
Military vehicles being autonomously driven from point A to point B and beyond.
Interesting as the vehicles come through beer bottle pass.
It has a 200 foot drop-off on one end.
We're seeing the fruition of the dream that Dr. Tether had about autonomous
vehicles going across the desert within a time frame.
Once again showing that DARPA turns dreams into reality.
[APPLAUSE]
>> The check goes to Stanley.
[CHEERING AND APPLAUSE]
>> Another page will be added to the history books, the DARPA Grand Challenge.
[APPLAUSE]
>> Congratulations to all of us.
What a great experience.
These are the results.
Somehow the line got turned around.
The 2004 distance seven miles was the first time and everybody just got past
that.
We're often asked what was the key difference between the two events?
How many so much progress in 18 months?
We talked about now the teams had a better understanding of what the route would
look like after the first event.
Some more teams got involved.
More integration, more testing.
For me personally what it really boils down to is one simple sort of adage which
is never underestimate the power of people willing to take on a challenge and
that's what you're all here for, the next challenge.
The next chart, please.

The vehicles, Stanley came in first, the average speed there was 19.2 miles.
Our objective was to get it up to those speeds.

Military relevant speeds and that's exactly what happened.
Next chart.

Sandstorm.
Fairly high at 18.7 miles.
Phenomenal performance.
And next chart.

Highlander 18.3.
How many of you saw the nova film about robots and Kevin Peterson, I still
remember this one shot he's sitting there with a keyboard and he's got maybe two
hours of sleep.
He has this smile and he said I'll sleep when it's over.
He worked so hard on that thing.
Congratulations to them.
Next, KAT-5. The Wall Street Journal has taken a number of stories on this team
coming back from the tragedy in New Orleans and have a vehicle finish.
They met with the chief judge and had a discussion this is a nighttime recovery
or do you want to let us stay overnight?
The chief judge said what do you want to do?
They said let it run.
If you look at the films this thing came in and was pretty much almost pretty
much dark when these guys came in.
They weren't worried.
We were but they made it all the way through.
You can see the headlights in the lower left-hand picture.
Next chart.

TerraMax, the first overnight operation of an autonomous vehicle.
We puased it when it got dark.
It spent the night in the field staying in pause all night long, engine still
running and low and behold in the morning at first light put it into run and the
machine moved.
Unbelievable.
Unbelievable.
Continued down the track and this is the one that all kept our hearts pounding.
Another one the team met with the chief judge and came to go all the way?
We're going all the way.
The next chart.

This track.
That's beer bottle pass tire truck.
Living on the edge, close to the edge.
That -- the vehicle -- it had to back up, reorient itself and go back down the
road.
In that one case the vehicles the rear wheel was in the air spinning and the
front wheels grabbing.
Living on the edge but it made it.
Next chart.

That's it.
That's the Grand Challenge 2005.
Great experience but I'm sure that it will be well outdone by the Urban
Challenge that you are all here for and interested in participating in.
What I would like to do now is introduce Norm Whittaker.
The manager for the Urban Challenge and good luck to all of you.
[APPLAUSE]

>> That video takes the prize.
It's nice to be here.
There is no place I would rather be on a Saturday afternoon than talking about a
robot race.
The game plan today is we'll start talking about the program up front and then
we'll take a brief break and go outside where we set up an incredible art show
in the street to take a look at that.
[LAUGHTER]
Then come back in and we'll go through some of the technical criteria after the
break and a lot of Q and A and try to answer the questions.
We'll hold most of the questions until the end.
The program objective is safe autonomous driving in traffic.
What we're really thinking about is no collisions.
We aren't trying to take all the problems on at once but we're focused on
vehicle to vehicle interaction.
Taking the pedestrian issue out of it and partition the -- and information in
the database, application and so on.
We've tried to put a box around the problem.
So that's really the game plan here.
The capability is the other issue.
Turns, stops, stopping at stop signs, proper behavior at intersections,
observing precedence order, passing, merging, stops and merging in moving
traffic, and parking maneuvers.
All those things are extremely challenging.
We know it is.
We'll try to lead you step-by-step and test the bugs out of the vehicles by the
end.
So we really hope we'll get some good experiences from it.
Robustness is the third issue.
The off-road.
We'll purposely go off-road.
You'll need to be able to dynamically reclaim the route.
Erratic drivers.
It's one thing to test them in a sterile environment where you know what is
going to happen.
The vehicles are in the middle of the road coming at certain speeds, but the
real world is not really like that.
By the end of this program we'll help -- in the test and vehicles need to have
an algorithm.
On the other hand it's an urban area and will be relatively confined.
A good chance you'll be out there -- [inaudible] we'll look at the roads that
aren't on any map or in any database.
You won't be able to see the road in the imagery that -- you have to
[inaudible].
As far away as it could be.
If you work with GPS you know outages are frequent.
You get blockages and we can't have vehicles sitting in the road for 10 minutes.
You need to be able to continue driving.
What you're going to see is tension in the program that is on the need for
safety and the need for effectiveness.
Safety on the one hand leads you the cautious solutions.
We really can't have people stopping on the road.
We need effective solutions with enough aggressiveness that you can get the
mission completed.
As we go through you'll see some of the technical requirements.
Pushing one way or the other to try to make the best vehicle possible.
Program scope.

This is a full statement of the program scope.
We will have passing and merging into traffic.
There will be dirt roads.
It won't be challenging terrain it will simply be a dirt road.
You'll need to detect that road with the sensors.
As far as speeds go.
Speeds greater than 30 mile-per-hour a speed for the vehicle so it would be quite a bit less than that.
No -- [inaudible].
Traffic signals -- some types of -- pictures we show intersections but there will be no red lights, no stop signs.
Intersections will be a stop sign intersection.
Sometimes multiple stop signs.
Sometimes stop in moving traffic.
Not difficult terrain.
One thing that Tony didn't tell you was the format for this, reason it's confusing is that it's being invented before your eyes.
Other programs that have been done before which have a track and you contract the track and so this great experiment takes us a little while to get all the pieces exactly right.
The rules will apply for both tracks.
Certain parts will apply for only apply to track A and it's laid out.
What we've published so far if you've looked at the website.
We welcome your comments.
Read them carefully and send in and we'll consider everything you send in.
We won't guarantee it gets in there but we'll look at it.
The program information that was published on may 1 it has some of the same criteria.
[Inaudible] Technical part of this and some of the other parts are intensive.
Right now there are certain inconsistencies with the rules and we have better information.
Right now the rules are better than -- our intent is we'll publish modifications to bring it in exact alignment with the rules.
That will be the next couple of weeks.
It won't be a grand change, it will be small things.
[Inaudible].
This is just a general statement.
We aren't making new rules today.
If I say something at some point, talk to somebody afterwards from DARPA and if they told you something it's not permission to do it.
It has to be written and give us heads up on some of the writings change and I'll give you a heads up today so you'll see -- really at the end of the day it is -- [Inaudible] They know where the information is and the rules are in the document.
If you attach them.
Get these guys with their badges on and corner them after this is over and ask them questions.
There are a number of other people in the audience from DARPA.
These folks are veterans and they know how it goes in the Grand Challenge.
If you're new in the audience ask one of those people.
[Inaudible] they have a lot of knowledge.
The game plan.
I'll give you an overview.
We'll start going over some of the details.
Then I'll talk about -- track A and track B.
First form a team.
I realize they aren't exactly in order.

Select track A or track B.
Use the flow chart.
You may have seen it in the FAQ on the website.
You have more decisions to make on track A.
Submit an application.
An application for track B.
Once you have submitted the application you already have selected -- you need know.
[Inaudible] simply develop the vehicle that can qualify with the different criteria.
The qualification process.
We're going to break it open and -- [inaudible].
First form a team.
In the rules it says there is -- we talked about track A first.
You need a team leader.
The team leader has to be 21 years old at the time that he signs the application.
And needs to be -- [inaudible].
The residency requirement we'll talk about what it takes to be a resident.
I apologize it not in the rules.
We'll try to catch that up as soon as possible.
It's additional paperwork you'll have to turn in.
You need to be -- in addition to the team leader the next are the team members.
Team members can only be on one team.
Looking for distinct entries.
You can't merge teams or join teams.
Individuals are on one team.
In addition to that we're looking for sponsors.
Go on the website and I'll give you an example of that.
No restrictions on sponsors.
Using assets that are government assets.
You can't use money from a government contract here and -- you need to get more information.
You'll see that in the application.
Next slide.

Documentation.
Two kinds of documentation that will be required.
One is for the citizenship.
Second is for the residency.
The citizenship requirement, you can either make a copy of your passport, an expired passport is also legal.
Citizenship documentation.
We'll take that as well.
Alternatively a current driver's license, can't be expired or birth certificate.
You can make a copy of it and send it in with your application and you're checked off.
When you have a site visit later on at the site visit you show them the documentation to the government people who are there.
In addition to the residency requirement, don't get too worried.
This is part two of the application.
If you read the rules.
If you're outside the United States you have time to come back to the United States and establish residency.
What we need are two of the following pieces of paper.
Utility bill not more than two months old for the team leader.
An example of the different things that are acceptable.

Receipts paying property taxes the last year.
Property bill or life insurance bill.
A mortgage, a mortgage statement.
Residential rental form.
The people who are watching this on the -- off site they don't see this.
I apologize.
These requirements -- [inaudible].
This is more or less what it takes to establish residency for the submission.
The [inaudible].
I know the FAQ on the website now says residency doesn't matter.
That's a mistake and it will come out.
A lot of the questions we have are from people who work for small companies.
A small company says I want to enter a vehicle in the Grand Challenge.
I don't understand the team leader and all this stuff.
How do I do this?
Well, in that case there is an individual who a selected, an engineer in this example, who should be the team leader.
She is the team leader, the team members are the only employees or others who aren't in the running.
The company becomes the team sponsor.
The company does not enter the vehicle, DARPA has a relationship with a single individual, the team leader.
We do allow -- we did last year allow the company to sign some of the legal forms, for example, the liability waiver and things like that.
We work with that.
Step 2.
Got your team formed, it's time to decide track A or track B?
This slide is intended to show that really except for the upfront part there isn't that much difference.
There is a little more-green in the top track than the bottom track.
More dollar signs.
You did more work writing the proposal than you did in the application.
The top track the proposal is sent in.
If you're selected, those selected go through negotiation, the announcement happens.
Come September you'll be on track A you'll have a meeting in September.
Someone will need to submit a plan.
Your development plan for that.
It's about half of the contract.
Half the contract -- [inaudible].
The rest of the money has to [inaudible].
The first milestone really is the -- the second milestone correspond with site visits.
Site visits takes place on track B and track A we go to milestone two and make a site visit -- [inaudible].
When the 50K comes when you -- the money is not because you did a good job but because you're bringing a vehicle in and participating.
You need to get to the next level to get the -- NQE.
If you make it to the National Qualification Event and participate in the -- [inaudible].
Also payments on track A are more typical.
50% and then 25% and then -- make sure I get it right.
Money at the end is the same for all tracks.
Three prizes.
So the final amount on track A -- it's due by -- [inaudible].
Just because you finish the race -- you can't get that until you -- [inaudible].
The tracks are actually similar to this.

Proposals on track A this application is on track B, track A has an optional
video that you should be making right now due June 23.
[Inaudible].
(Please stand by)
>> >> The answer is yes.
Money from the government isn't intended to be the only funding source.
You can raise as much money as you want in addition to that.
Now the use of government program assets.
I touched on that just briefly.
If you have government contract, a SBRI, small business contract or you for some
reason have a government vehicle, a government robot and you've been given
permission to use inside the Urban Challenge.
We're just trying to connect all the government documents together as far as the
program goes.
Next slide.

OK, developing a vehicle.
Now, we said a little bit of back and forth.
We put the tip out.
It said we needed to have a full sized commercial vehicle, production vehicle or
a vehicle with a document -- and what we were looking for when we said
production vehicle we have concerns about experimental vehicles for the Urban
Challenge.
Vehicles that are production vehicles they get in a collision there is a certain
amount of collision testing done with that vehicle and it's unlikely this
accelerator would be stuck on or that you would rear end it and it would blow up
or something like that.
One of the testing gone in the vehicles have taken out those bugs where it's in
the experimental vehicles we're less confident that has taken place.
We went through and looked at last year's participants and did a lot of
analysis.
We didn't come up with numbers.
2,000 to 3,000 pounds is the manufactured weight as delivered from the
manufacturers with a full tank of gas.
Some people -- someone told me that the vehicle manufacture comes with a whole
bunch of sensors, do those count with the weight?
The answer is yes.
That's part of the weight.
Wheelbase issue, 72 inches is what we chose for the minimum.
The maximum is set by tactical concerns.
If you take a two lane road which is 30 feet wide with curbs on either edge you
need to do a U-turn inside that curb.
It needs to be able to do the U-turn.
If you are a fire truck or a school bus or whatever it is you want to enter can
do the 3 point turn you can do it and it meets our needs.
We don't have any other requirement past that.
We looked at last year's vehicles and the criteria.
Cut out a few of them.
Most of them had an alternative vehicle already they talked about on their
websites and we think this is a pretty inclusive rule.
So we talked about the production vehicle and the documents and the safety
record.
You might ask what is a documented safety record?
We want to talk to you about that if you have a vehicle that's a specially
manufactured vehicle but used in races around the world and survived collisions
and so on.
That may pass the test.

If you have a military vehicle that has safety testing that may pass the test as well.
Be happy to work with you on what it means to enter a safe vehicle.
Another requirement for the vehicle, this is the same as last year, a manual E-Stop is retired and manual e-stop is something on the vehicle and something we want to have on there.
It is the panic button on either side of the vehicle that will disable the vehicle if it is getting away.
So it needs to be visible and labeled on either side of the vehicle.
You can read in the rules what the requirements are.
We've taken off the requirement that it's labeled in Spanish.
Just has to be labeled in English this year.
Similar to last year, wireless communication with the vehicle is prohibited.
That's a good rule there.
It is a complicated rule.
I understand that GPS perception and wireless communication and there are tracking systems that require wireless communication.
If you're receiving navigation signal, all those are allowed.
Emit with sensor the returns.
What you can't do when your vehicle is autonomous on the course is receive any kind of guidance or control signals and you can't download data.
You can't stream video from the vehicle or do anything like that.
If you're wondering whether it's doable, send me an email and we'll have to figure it out.
Warning light and audible alarm those two are the same as last year.
Bubble gum machine on the top with a yellow light on the top when its autonomous.
Look carefully at the requirement and rules.
It's changed slightly.
We have some safety concerns.
Right now the audible alarm that beats intermittently and the warning light need to be on when the vehicle is in run mode only.
When it's in pause they need to go off.
Ron caught a safety bug in that.
In addition brake light stuff was in there last year but directionals weren't.
In order to tell the people watching what the vehicle is about to do you don't expect the vehicles to see each other's directions.
If you want to try to do that that's fine.
For the people watching, observers, it helps to interpret what the vehicle's intended path is to see it turn.
We need to see the directional turn go on to make the turn.
That's in the rules this time.
By directionals signal light in front and back.
Now, this is something, a new requirement this year, last year we let some teams at their site visit have a rider in the vehicle who wasn't recommended but if they didn't have a way to do an emergency stop with the vehicle we would let a rider go in there, put his hands like this and hit the brake if the vehicle started the run amuck.
We're more sophisticated now and a much more capable community as we have gone through this process.
We're requiring you to have a wireless stop for the site visit and you want to have it for testing anyway.
It doesn't have to be a government stop.
It doesn't have to be one of the army type ones.
Those are multi-channel and have expensive radios and cost $10,000.
If you get it cheaper you can get $1,000 version.
If you don't know, shop around and get something that will work for the price.

It needs to be able to ride in a vehicle behind the robot.
It's a real requirement.
As before, we will, once we pass the site visit, we'll check you our government furnished equipment.
We're fixing the switches on them.
We're trying to solve some of the bugs.
They still work pretty well and are pretty reliable.
We'll switch them on probably the same design.
That hasn't been fully decided yet.
The vehicle requirements that you have and in the rules will change slightly.
They'll become more specific and be the same in both.
Expect that over the next couple of weeks.
You have made it through the application process.
We'll talk about this in a little more detail.
The application process included the part 4 of the application plus the demonstration video.
I'll tell you all about that.
The next section.

The qualification process includes -- for track A and NQE which are milestones three and four.
It will be a little bit different.
Stay tuned.
Don't make assumptions about how it worked before.
It is going to be different.
Here is the site visit detail.
This is really similar to last time.
The dates inside there are a little wrong.
We're trying to help you schedule your vacations so we've nailed down a time
July 11 is -- June 11 is the start.
We tried to get them in the first two to two and a half weeks and we needed to budget more time for -- that's the rest of it.
Most of us these visits won't be in July.
They'll be in the end of June in 2007.
As before, the location will be in the United States.
If you want to take us to Hawaii that's fine, we'll go.
Alaska, who even did that one last year?
We don't have really the budget to do international travel so everything takes place in the United States.
You choose the location, we choose the time.
We'll choose the time when we can work with you to a very limited extent.
There are so many things that need to be scheduled we have just a limited number of segments to come during the visit.
We'll need you to block open a morning or afternoon in that time for us.
When we tell you which morning or afternoon to block out.
Last year they were 2 1/2 hours max.
It is more complicated this year so we're leaving four hours for the site visit.
It could happen faster but we're budgeting more time because there is more stuff involved.
The RNDF gives the route.
The team will produce an RNDF for the site visit.
We need it when we show up to know what we'll be facing.
You give that to us in advance.
I think that's a March 2, 2007 requirement.
We're asking the team, when we arrive, our guys will show up with the vehicle.
We're asking the teams provide two vehicles in addition to their autonomous vehicle.

One of them we're calling the traffic vehicle.
If a vehicle gets crashed into by the box it will be the traffic vehicle.
Don't use mom's car.
Just somebody else's car.
[LAUGHTER]
Younger brother is a good choice.
In addition there is a control vehicle.
The control vehicle is going to function like the DARPA control vehicle, it's a following detail.
We'll lay out the details.
Be prepared for this request.
Two vehicles in addition to the autonomous vehicle.
DARPA guidelines will be published with a full list of additional things we'll publish.
So this is not the full description you heard today.
The selection announcement is on or before August 10 of 2007.
As far as the format of the site visit if you haven't been through this before, typically two DARPA officials show up, they meet with the team leader.
The team leader shows them, remember, he needs the documentation of his citizenship and residency.
Send photocopies and we need to see the original.
Save it to a file and he verifies all that stuff.
In this case he'll give mission data file.
It tells the vehicle what to do on the RNDF.
So we will be controlling.
We'll be setting the track of the vehicle on site.
You'll need to be able to read the files at the site visit.
That's an early requirement in the process.
Next slide.

NQE.
I think it says October 21 to 31.
The location to be announced.
Don't make an assumption.
Teams need to be arrived prepared.
Assume that you'll have to get on the track and go.
You'll -- the first step always is that safety test so you'll -- the test it.
We did that by -- we first inspect the vehicles to make sure there wasn't anything dangerous, do a dynamic test and we check the pause and E-stop so kind of a standard thing.
I think everyone passed last time.
Then what we'll do first is the navigation test, a non-traffic test.
Static vehicles.
The vehicles will be given an MTF and once or twice take a complex route they'll have to run successfully within a time.
They'll actually qualify for the second half.
If you pass the test and you've passed milestone three and you get your paint.
Milestone four is different.
The second half we'll talk about that.
It's not going to be run a row and if you make it through you passed.
Because of the traffic and the nature of traffic we can't afford vehicles unless they're confident.
It will be more like 20 times repeated tests merging into traffic.
20 integrations to see how you do again and again and again and again to prove you're competent.
A little different than last time.
If you make it through this you have a very good vehicle.

That's the repeated test in moving traffic and it is all intended to prepare you for the final event.
The tests we took are not arbitrarily chosen.
Except for the hay bales everything we put there is linked to something that's in the route.
So our goal, let me say that, is really -- this is not a demolition Derby.
We'll see very capable -- we just won't have the event.
It's an option on the table.
You must be able to pass the second half of the NQE in order to move to the next step.
The next slide.

Question the always comes up is how many teams?
This number has been released.
How many teams go on track B?
The answer is, there could be 20.
We can hold 20.
Once again you have to be capable to actually qualify.
It is not worth anyone's effort to bring the vehicle there if it is not going to effectively compete with the other vehicles.
If track A passes we'll do as many site visits as we need to.
We'll submit videos and if you have a qualifying vehicle and you check the boxes we'll be there for a site visit.
We'll pick something like 20 to move to the next level.
Track A the 10 teams that -- or fewer teams selected in the beginning will be automatically -- if you pass the first milestone, you wrote the plan, you can -- the director pointed out and so some fraction of those selections, which is the next slide.

Only fully competent vehicles will be in the final event.
I'm not a betting man but it will be tough to actually make it to the NQE and to the final match.
Be prepared.
We aren't going to dumb it down and just let the vehicles in there who seem to be pretty good.
I'll tell you how the final event is going to work of the Urban Challenge.
This is a schematic thing so you get an idea of what we're thinking.
If you read the documents you know you have a route network which has been defined.
Doesn't have a start or endpoint really but it has checkpoints.
Defined checkpoint.
It's an identified way point someplace on the ground out there achievable by a vehicle.
This example shows five checkpoints, OK?
Help should be labeled one through five.
Whenever one of these stars comes up, that's a checkpoint.
Here is the urban route number.
It's shown as a grid.
It doesn't mean it will be run on a grid but that's what Power Point made me draw.
All vehicles will be on the course at the same time.
The start almost simultaneously and we're going to measure the competency of that.
These will be very competent vehicles going at modest speeds and they will be completing -- by visiting checkpoints.
That's the one that ended up -- visit means achieve the checkpoint and I will tell you how you do that in a minute.

The first question that comes up is see the checkpoints, what is the actual
event look like?
How do you create equivalent missions?
I'll give you an idea how you might do that in the next slide.

If you were to race a bunch of those blocks and take them on the network and
leave the four corners, connect them in the middle by something that is a
traffic circle.
Could be a four-way stop, by connecting them like that I can set up routes
across the center point.
I sent it to a checkpoint in the corner.
Bring it back to the center point.
I take it to another corner and bring it back another corner, bring it back.
All the teams are doing that.
Sort of the guaranteed traffic load in the center and you're achieving the same
checkpoints but in a different order.
The example shows four in between.
In order to drive you back to the traffic circle every time I need to use
checkpoint four.
I can send you the same track.
This sort of guarantees that the minimum distance how I tell you it is going to
be 60 miles.
If you look at it with a relatively modest number of vehicles it's a relatively
small size route area in order to get any kind of traffic interaction.
This kind of guarantees traffic interaction at the center point.
Next slide.

The final -- here is another really fun thing about the final event.
The route network first of all, the RNDF we'll tell you about that at least 24
hours in advance.
We've made it 24 hours in advance originally.
At the last minute we find bugs in the network for the dangerous places and
things we want to take off we've given ourselves a day beforehand to get the
work done.
You'll get an early look at exactly what the route is.
The challenge is the traffic, not what the route is.
You'll know all about the route.
And they will perform multiple missions.
A mission is a set of checkpoints you have to visit in order.
The mission is to visit a lot of places and bring it back to the start.
So when you come back I'll show you how it works.
You get another mission.
And the clock will be running when you get your other mission.
So you are going to need a pit crew with your team who will be at the start area
to take custody of the vehicle, load the new mission onto it and get it launched
back out into the route as soon as possible.
One of the vehicle requirements we've put in there, there is a five-minute
requirement on loading.
You have to test that.
You can do it much faster than five minutes.
To help you know the expectation is that you don't have a chance to get the
route and study and analyze it.
The vehicle will do all that and do it fast.
So you're going to get a memory stick from us or a flash drive, plug it in and
you'll go.
Let me paint that picture for you.
This picture shows the big box in the middle is the start area.

That's where the start and finish will take place.
On the right-hand side there is a big blue blob which is the route area.
That includes all the checkpoints and everything.
What you see is six -- six start chutes identified there.
Every vehicle that is running gets its own start chute.
What we'll do is your vehicle will come up there.
There it is block.
Robot 12.
Robot 12 is coming off the route on the right-hand side.
It will come to the final mission waypoint.
The final point.
Now it has to stop at the final point.
DARPA will take custody of the vehicle, stop/pause it and turn it over to the team.
The team's job will be to load the vehicle back inside the start chute.
You need to transport it over here and they need to load the new MBF in it and other mechanical things they can do at the same time.
I mean they can wipe off the sensor if it's covered with dust.
If they have a flat tire, they can change the tire.
They can't download information from it and study it and use it for future mission, no.
It's just mechanical things to keep the vehicle going.
A minor repair you're able to do.
You shouldn't take 30 minutes here.
So you reload, you'll launch.
Be back out starting the next mission.
And so the last grand challenge we see you guys laying around in the big tent drinking and eating so it's let's get those guys to work.
You'll have to stay ready at the start area.
That was the overview.
You get an idea of how the Grand Challenge is going to be run.
We'll now drill some of the programmatic details into track A and track B.
If you looked inside the paperwork we invented this job called contracts and agreements, the CAR.
She'll tell you about track A and lead you by the hand and after that we'll go back and do track B and be ready for a break.
Thanks.
[APPLAUSE]

>> Good afternoon, everyone.
As Norm said I'm Kristin Fuller the Contracts and Agreements Officer.
I could stand up all here and talk about contracts but I know the rest of you wish I wouldn't.
I'll make it as quick as painless as possible.
Track A as Norm pointed out is the track that you'll propose to get a contract.
This chart shows the basic information.
Some that Norm pointed out to you.
When they're due.
When the amendments will be posted, things like that.
We can move on to the next chart.

My title gave you a clue because under this BAA we're only going to be awarding contracts or other transactions for prototype agreements.
So you need to keep that in mind as you're deciding what type of contract vehicle you wish to propose.

All of your proposals must be entered into the DARPA system prior to the proposal due date and we have instructions for that on our Grand Challenge website.
And don't wait until the last minute to enter your stuff in.
You'll need to get a password in.
There may be technical difficulties so you don't want to wait.
OK.
This is the part Norm said you'll pepper me with questions about and I'm ready.
Not to worry.
You don't want government purpose rights.
All the milestone reports and your milestone meetings and technical interchange meetings and documents that come out of those.
Anything that is military property created solely or in part with government funding will need government purpose rights for that as well and require unlimited rights to your vehicle technical paper.
If you bring in some existing I.P. in the table you'll need to submit this list as attachment E to your proposal that documents all the pre-existing non-commercial components that you're asserting a claim to.
That means you'll ask for limited or restricted rights to that data and there is more discussion of that in the PIP at paragraph 3.2.13.
OK.
And foreign access to technology.
You need to notify DARPA if any of these arms export laws apply.
And if you have a conflict of interest we'll need to talk about that, too.
We want an affirmation that you have one and how you'll mitigate it or that you do not have one.
And the way the indemnity and liability.
That's a copy of in the PIP at appendix C and sign, notarize it and attach it.
Any contractor agreement proposal that you submit should not address profit as an independent separate element.
We're attempting this project to stimulate research and development and we're not acquiring it through services.
Those are two distinct things that apply to profit.
So what we want you to do with this money is apply it to your technical effort and the promote your R & D.
If you're interested in another transaction agreement there will be a model -- there is a model included in the PIP.
I have appendix B, you should include that model tailored as you see fit as attachment B to your proposal.
Here is kind of an overview of the difference between a contract and other transaction.
A contract you're buying -- acquiring by purchased, lease or barter a property or service for the direct benefit or use of the federal government.
That is a pretty broad definition.
Other transaction for prototype is more narrow because you must be actually building a prototype project.
You have to be working on a prototype project in order to qualify for that.
So working on DARPA Urban Challenge is definitely putting together a prototype project.
If you're interested in that you may use that type of agreement.
There are three requirements forward -- you have to meet one of these three requirements in order to get a prototype.
First agreement is you are a non-traditional defense contractor performing to a significant extent.
Either you as the prime contractor or as is subcontractor on your team have sent in a very important part of your project is a non-traditional defense contractor.

You could provide a 1/3 cost share.
The other kind you could get another transaction when a executive determines an exceptional circumstance exist and we don't intend to allow any of those in this particular solicitation.
I mention that cost sharing was a possibility if you wanted to see another transaction.
I just anticipating there will be questions about that.
We've come up with this chart to kind of explain what type of costs you would be able to cost share.
If they weren't actual cash contributions.
Want to make a distinction between current costs and some costs.
Current costs would be something that you are acquiring once you receive the award.
A new piece of property you want to bring to the table and use as part of your cost share.
For example, if you are going out to your local Ford dealer and buying a truck that you're going to install with your sensors and other equipment on you could say you bought that truck with your money and that's part of your cost share.
Now, another cost would be something that you've already purchased in the past and for example like your existing DARPA Grand Challenge 2005 vehicle.
That would not be considered adequate cost sharing because it already exists and you would be getting the recognition for the value of that vehicle as part of your performance evaluation when we're evaluating your proposal.
The best forms of cost sharing that you could actually propose would be cash or independent research and development dollars, that would be because we can put a value on them.
That example I made about the Ford truck, that would be -- we would have to determine that based on an amortization over a five year depreciation schedule technical contracting garbage.
It would not be the full value of the truck.
It's easier if you come to the table with cash or IRD contributions.
These are the evaluation criteria in the PIP.
They're listed in descending order of importance.
The technical approach.
The management and funding plan and the strength of the team.
We'll score each of those topics on a ratings scale from one to four where four is the highest rating and one is the lowest.
OK.
Now I need to ask Norm clarification.
I believe the pip says companies can be on multiple teams as subcontractors, correct?
If you're a company, university or
>> We also need the right number definition of the suit, we talked about that as well.
So that's March 2, 2007, April 13 is when the video demonstration is due.
Back in January, are there's a date in January we'll have the format for the administration, get it up earlier if we can.
Drop-dead date for U we'll get all the format information, tech papers and so on off to you guys.
The video, a little tighter this time.
Five minutes -- send it in on D.V.D. -- last year we asked for three different formats, and then we picked from Microsoft and converted them.
Why don't you get that from Microsoft, download from the website, get them all in a compressed form, on track A, send the video in with the proposal, limited size, I think 100 M, needs to be uploaded -- details there, realize that's true.
So five-minute limit on that.
We are not specifying what needs to be in there.

Track B it will be maneuvers and activities that take place on the site.
The emergency stop system, two of the boxes go on the profile, one is the
control.
Set up multi-channel -- two boxes, one of them is more or less a control box,
it's got two outputs, and activated -- relatively simple, all the details on the
website.
We actually put the preference -- it's simple to integrate -- you are not
laughing or anything.
>> Actually it's more than just two outputs.
Explain the difference in the documentation, more or less pause is going to be
pause -- put the brakes on, the engine stays running.
Disable, when you need the brake.
You can test both of those.
Technical -- track A, we'll send you the format of the technical paper by
January.
Track A, mail it in -- okay.
Tell you exactly what to do with it.
You can write the tech paper -- the contract later.
Track B site paper is due in advance.
I know what you guys like to do, I put the format up there, of the things I want
-- you just take everything I ask for and you give me a paragraph after it.
This time we are evaluating the tech papers as part of the site visit, track B.
Don't do that.
Write a good paper this time.
Professional quality.
Explain clearly.
And posted on the website -- the other -- the tech paper, don't worry about
placing information in it.
Definitive information, no one will know about it -- summary schedule, if you
have bin oculars you can read it.
It shows track A at the top, track B at the bottom.
First full vertical bar says today up there.
You can see that's today.
This has the dates on it.
You put it on the website -- on the top you can see proposals and then awards,
that's going to take place this summer.
So we'll start negotiation in September.
Let me just lay one detail on you about that.
People have asked me about the sample agreement that we have.
Sample agreement, okay?
If you're going down the track, choosing to stipulate an OT track A,
transaction, take the agreement and read it and you look for things in there
that you can't live with, and you mark it up, contract people will negotiate
with you to see if we can find some common ground in that contract.
If you need more flexibility in negotiating that, our contract is familiar, less
familiarity, the people who know about the contract have the contract in their
possession.
No need to mark up the contract and send it in, okay?
So traffic one up here shows milestone one that takes place in the fall, in
October.
After the due date down below, after October 5th.
Also the site visit, there are two milestones.
Two milestones, three and four, that take place, it straddles over to complete
milestone for you, you have to actually attempt that.
You can't just -- you can't -- you have to be there.
Down below, the parts of the application, there's a 5/11, announcement day of
the site visit, and the visits will take place during that time.

>> Okay.
Made it.
Break is up now, take a ten minutes break, slightly off schedule.
If you go purchase -- okay.
Ten minutes, see you back here.
Thank you.

>> Okay.
Here is the game plan.
We are going to start with the rules definition.
We are going to talk through the RNDF.
I think a lot of you have seen the details of that.
And we are going to give some examples of the technical criteria.
We'll start operations.
Okay, everyone.
Let's get started again.
Thank you.
Okay.
Here is the plan.
We'll try to get to the questions as soon as we can.
I'll give you the cook's tour of the route definition.
A lot of you have been grinding through that document, I know.
Look at some examples of the technical criteria, and talk to those, and then
look at the rules.
We have some examples of the critical rules you need to know.
Then we'll get to Q and A.
Go to the next slide.

Okay.
You all know the RNDF, MDF.
RNDF, at least 24 hours out.
One RNDF, multiple MDFs, they are cross linked and cross referenced in the
definition.
And what this shows, multiple MDFs, at least five minutes.
Perhaps you have seen this chart.
It shows the container class diagram for the RNDF.
Basically if you've been through the document you know it's a consistent
numbering for every element inside the RNDF.
Segments and zones are numbered the same.
They tend to be in -- integer numbers and zones come last.
Segments are basically, it's not a unique mapping to the physical road.
A road with the same name, like New York Avenue, we name it as one segment.
Lanes contain waypoints.
Zones are defined by a perimeter.
No points inside, except points that belong to parking spots.
We can answer questions on parking spots if you like.
We'll show you a picture.
Next slide.

You have seen this in the document, multiple lanes.
It's a segment M, and three lanes.
M.1, M.2, and M.3.
We defined the markings.
One question that has come up is the markings that you see inside the RNDF, are
they always present on the physical ground?
The road markings are.

If we tell you there's a yellow line there, and your camera looks down there, it
will see a yellow line.
But then, we'll put stop lines wherever we call for a stop sign, there may be
not a red stop sign, okay?
But we will have the line on the ground.
You can see the points, the green dots inside the truck.
Perhaps you have been through this one as well.
There's the notion of exit points, those are all colored on the chart.
One exit, exit to multiple entry points on other segments.
This is how all the segments are patched together.
Stop signs are called out, every stop sign is associated with a single waypoint,
a stop line going through it.
Next chart.

And the star and checkpoints, this shows in detail how to visit a checkpoint,
what do you have to do?
The rule is the front bumper of the vehicle must completely pass over the paint
marked on the ground.
If there's an observer there, they will tell.
You have to be in the right lane going the right direction.
You can't be in the lane and can't back up to it.
You have to be going forward and reach the point that way.
You can't go in the wrong direction and pull over and pick it up and keep on
going.
Okay?
I know what you are thinking.
Here is an example of some of the road markings, what we would do.
This shows a double yellow, that would be in the RNDF.
The white line there may not be in the RNDF.
If there's curb there, we may leave that out.
There may be lines on the ground which we don't put inside the RNDF.
The stop line, well put that in.
Curb may or may not exist in the real world, you don't know, you have to tell
us.
The line extends for lane width to the curb to the centerline, that's where
we'll put the wave point.
It's not necessarily in the travel lane, we don't go from the white line on the
ground to the yellow, we go from the curb to the yellow, okay?
Next.

Here is the other kind of creature we defined, a zone.
Some of them have obstacles, some don't.
Really they all have obstacle, some have parking spots and some don't.
So the obstacle -- this shows an example, you can see the odd-shaped polygon in
the middle, two red lines, it's marked K rail.
Don't drive through the K rail.
Next to one of the K rails we put an array of parking spots, okay?
Parking spots are not marked on the ground.
No parallel white spots.
Just look at the distance between the waypoints and checkpoints.
Your job is to come in one of the segments and pass over one of the checkpoints
and achieve the second one.
If you don't, then you'll have a problem.
For example, you can't achieve it by just going in from the side, saying there's
a waypoint there, go achieve the waypoint -- I mean the checkpoint, you can't do
that.
You will hit other vehicles in the way.

We'll is other vehicles, junk cars parked in the spots.
You have to figure out what's inside the zone using your sensors and find the right path to go and achieve the checkpoint.
It's not easy.
Next slide.

We talked about the RNDF, here is the MDF.
Relatively simple.
An array of checkpoints.
The first checkpoint doesn't have to be one.
Look at the example we gave you, study that carefully.
When we made that, we looked at the things on the road, it's hidden in there.
It's like a real Da Vinci Code puzzle.
Study that in great detail.
We may repeat.
We have given multiple instances of the same checkpoint.
In addition, we put speed limits inside the file.
Remember the multiple missions we'll give you, this gives you a chance, if the vehicles are going too fast, you can slow them down or speed them up.
It gives DARPA a little control over the event which we otherwise would not have.
The speeds are listed per segment.
You see it in miles per hour.
Some asked me is that 10.1, 10.2, I said yeah.
[LAUGHTER]
Next chart.

Okay.
Technical criteria.
We'll talk about some examples.
This is a slide from the PIP.
More or less we have partitioned the criteria into some batches.
So basic traffic includes basic navigation, so on and so forth.
This shows, for example, the site visit will only use basic navigation and basic traffic.
But the NQE, or the final event, that uses all of them.
It comes into play.
I'll show you an example of that.
It's a little unexpected.
Look at the criteria for advanced traffic, for example, and suspect only those things will be tested, that's not a good assumption.
Some of the things for basic traffic will be tested as well.
These are some examples.
Look at the list over the next two weeks.
We may add to the list, change some of the numbers, this is our state of thinking at the moment.
Some of the things are easy to draw on the chart.
Basic navigation, the vehicle stays entirely in the travel lane around corners.
I think this is pretty obvious.
The corner aspect, it wasn't really required.
You saw the video, the team did the landscaping job in the corner.
Next chart.

So there's the requirement that you stop within a meter, that's over or back, front bumper of a stop line and the ground.
Next chart.

Vehicle exhibits less than ten seconds of delay when the intersection is clear.
There's a tension between vehicles that are too cautious and those that are not cautious enough, once you stop there, it's your turn to go, if you wait more than ten seconds you are not effective.
Somebody is honking from behind.
Not a good scene.
So there's a few places where we talked about this ten second delay.
We don't know how it's going to be used at every time, but we'll whistle you dead on this if you are thinking too much in the parking lot or some of the intersections.
So this shows where the clock starts.
The precedence was for the traffic vehicle, the other vehicle that wasn't the robot.
It turned the corner as soon as it turned the intersection, ten seconds, let's go.
Another basic navigation, vehicle completes a passing maneuver in 40 meters or less, maintaining an 8 meter safety buffer.
We have a scheme here, I'll let you study it on Monday when it goes up on the website.
It short of shows, you know, once you are fully in the other lane, begin to leave the lane, that's where the 40 meters start right there.
When you fully back in the lane that's where the 40 meters end.
We went out and did some experiments with vehicles.
We may put a vehicle dependent element to this.
It's kind of a work in progress.
Something like this.
We need to see vehicles that can effectively pass stopped vehicles and continue to go.
Next slide.

Okay.
That was tested at the site visit, all those things.
You can expect that to be tested at the site visit, in addition to this.
Vehicle exhibits correct precedence order in intersection.
First guy into the intersection is the first guy to leave.
You know the rule.
It's complicated.
When your vehicle stops behind another vehicle, it should interpret it as a stopped vehicle, decide to go around it and that's no good.
One clears the intersection, another pulls up and fills, you track that.
It's not just detecting a blob there, it will look like a continuous blob there.
Proper cueing at the intersection, see the stop and go vehicle behavior as vehicles fill and then move.
That's actually required so -- let's go to the next slide.

Let me just through these.
We have requirements on how far you should stop behind another vehicle.
We can't have you stopping way far back and having you avoid collisions that way.
Too cautious behavior will get tested out of here.
Next slide.

There is a front vehicle that's traveling at 15-miles-per-hour the box following.
Box can get as close as 15 meters.
20-miles-per-hour zone, the box should be less than 40 meters away.
That's the rule that I just said.

You can't follow too cautiously.
Next slide.

This is called out actually in the RNDF.
It says that if we give you an exit and an entry point in the same road segment,
one lane to the next, implied behavior is a U-turn, just like this.
It's written down there.
Here is a picture of it.
It's not hard to figure out.
The U-turn can be a three-point turn if that's what you need to get around the
corner.
That was the site visit.
Here are some additional components we are adding for the first part of NQE.
All static vehicles or no moving traffic here.
Here is the parking behavior, you know what that looks like.
Has to be less than ten seconds of delay.
How do you measure the delay?
Sort of a stop and stare issue.
Go to the next slide.

Excess delay, avoid jamming up roads and excess delay stop and stare.
Let's suppose you get a jam up in the parking lot, it could happen.
We are not going to time you ten seconds and get you in trouble.
It's a real world measurement we'll do.
[LAUGHTER]
This is a suggestion.
When that traffic jam takes place, your vehicle can't just freeze and say I have
no idea what to do.
We need some kind of solution.
So Ron wasn't sitting here.
When Ron was a teenager he was in New York City, driving a taxi cab.
And it's simply inch forward and don't hit anybody and see if you can't get
through this, okay?
So we need to see robust behaviors like this to get you out of the problems.
We'll stage some of these problems for you to try and solve.
This is not a sterile test where we give you, you know, the vehicles in the
center of the lane, real world is like this, it gets all jammed up.
Bot has to be able to cope with it.
Next slide.

Here is the dynamic replanning.
Robot is down in the lower left, three legs the robot could take up to the
checkpoint up there.
And just a ton of behaviors that have to be done in order to achieve this
correctly.
If it tries the first leg, it needs to do a U-turn.
The roadblock is not in the RNDF.
It needs to detect it, turn around, and make a left turn across traffic and
tries the next leg.
Then hits the next roadblock, it needs to find the right path back.
It may end up in the other again, and stuck in, you know what I mean.
Needs to make another left turn across traffic and find the third leg, okay?
That's a required behavior.
Next slide.

Here was a, there's a little language in I think the PIP about low accuracy
waypoints.

The example on the right-hand side is from the sample RNDF, it's the road on the far left.
Intersection there that isn't even called out in the RNDF, you can see it on the top.
The Bot needed to see the checkpoint was over here, and it knows to take the road to the right.
If it continued to go right, we would put a K rail there and it would eventually do a U-turn and find its way back.
Sparse road there.
You have to do road following.
And in this case we put it on a one-way road, that's kind of what we are thinking.
We don't want people doing U-turns on one-way roads.
It can get hairy.
Here is sort of an example of the road following your vehicle might need to do.
It may need to follow curve, berms for the urban case, or the vegetation on the bottom.
Clearly a visible road that could be detected, and even slide berms that could be detected.
Street lanes may be missing through the entire network, you have to hug to the right.
It could be a two-lane road without a street lane, we are reflecting what it shows in this area.
Winding roads what you saw, sparse wave points may not be in the center of the road but do our best.
Next.

Okay.
Advance traffic.
Here is a fun one.
This is something to pay attention to.
Two on the slide.
First one says the vehicle should pull into traffic when oncoming vehicles leave a gap of at least ten seconds.
If the vehicle is ten seconds away, oncoming traffic and you are waiting because you think it's still not safe enough, then you are not being effective, okay?
The road here shows just how complicated that can be.
This is actually a traffic circle and the radius of the circle, a good number to think about, 150 feet.
It's actually a pretty big traffic circle.
It's got a limited sight line, you can see the building up there at the top.
You have the RNDF.
You know the shape of the road.
You'll see the vehicle coming.
You need to detect them other than simply directly 90 degrees.
The one at the bottom shows two robots, and 8 meter safety spacing.
If you pull out and cut off the other guy within 8 meters, no good.
Coming too close behind somebody else within 8 meters, it's no good either.
We need to see the safety spacing between vehicles.
Next slide.

Two kinds of left turns.
We'll test you in detail.
Both of the left turns are across moving traffic.
You have two streams of traffic.
One down the bottom you have to watch out for.
Vehicles going in both directions.

You have to detect both of those, and then the top simply watching the oncoming traffic.
This slide shows another advanced traffic capability, operating in the parking lot with other vehicles present.
A vehicle coming in from the top, a vehicle from the bottom, they are both trying to achieve parking spots.
Our guarantee is we won't assign you the same parking spots.
Okay?
But there could be hay bales there.
This is an example of a behavior, probably testing advanced traffic which is one from basic navigation.
It says don't collide with anything.
It shows the robot coming along, accident avoidance, we'll roll a junk car out in front of you, we'll tell you what the spacing is, what the speeds are, you need to not collide with it.
It's something that some commercial vehicles can achieve, we need to see our Grand Challenge, and Urban Challenge do that as well.
Technical criteria, that was examples, there are more, so read through those.
Each of those tells a whole story.
Then operations, this is really the rules section.
This tells how we are going to do it.
So this is where you get to know the chief judge really well.
DARPA will have official observers on the course.
Causing a collision is grounds for disqualification.
If you hit somebody, it's just out.
There is no appeal process there.
If you are driving dangerously, you are out.
You endanger the other vehicles in the road.
If we see that, the sensors are misadjusted, it's all over for you.
For traffic infractions, time penalties.
We'll publish a table, tell you what it is.
If we catch you speeding or have another problem, you exceed the ten second delay, you could be whistled for that.
We'll add seconds to your committed time.
So the document called rules of the road will be released, we'll tell you what the rules are.
Next slide.

Collision.
What happens when there's a collision?
We are not going to have chase vehicles because it creates extra traffic and too much hazard out there.
We will have DARPA-generated traffic as well as vehicle traffic.
If we have a collision, we need to stop everyone, so we'll do an all-course halt.
Assess responsibility for the collision, and it can be a no-fault situation where they just sort of come together and decide what the next step is.
That's a job for the chief judge.
A victim vehicle, clearly not at fault, and collided into, may be allowed minor repair and restart.
Okay.
Major repair, if you lose an oil pan or radiator, it's not going to happen.
We are sorry.
It's part of the event.
But minor repair, a flat tire, pry the fender from the bumper, we'll bring you back to the start area and do the pry and send you on your way.
Time implication, we'll let the chief judge know.

DARPA will not use E stop.
Don't assume someone is watching the bot, and someone is heading toward it, they
are not going to pull the plug on it.
Not enough reaction time.
Fast maneuvers at the last minute.
So we are just going to have to live with the results.
Next slide.

Time correction, the time is sort of like the last Grand Challenge.
We measure elapsed time from the start to finish.
E stop pause, we take that out.
Start chute, some are further from the start than others are.
The time it takes you to get to the start line, we'll subtract that out.
Penalties assessed against you, the chief judge gives you time back because you
were crashed into, or any other reason he decides, that will be the final time.
And time between missions, the clock is running, so the pit crew has to be fast.
Next slide.

Pre-running
Let me just say something about pre-running.
The key thing to know, it's not going to really help you.
You'll know the course plenty in advance.
The challenge is not to know where are we going to come at the event, it's to
actually have a Bot that will be able to deal with the traffic on the course.
The traffic is where the real challenge is.
If we can work it out, we'll give you an image.
Just like in the sample, you'll get overhead imagery, geo-registered, and put
your own waypoints in there.
It's actually about the traffic and being able to navigate the course.
 The course area will maybe close before the event.
We did it last time, we may do it again.
Emphasis is on technical approaches using the same information.
It's cheating, not allowed to try and do overflight or get information that
everyone can't have.
Actually this is a technical comparison, so we need you to live within the
rules.
Use the information we give you.
Next slide.

We are going to publish a whole punch of -- bunch of rules, documents, give you
the details in advance of the actual events.
A couple were already out.
We appreciate feedback, even when we publish these, we find errors.
Let us know.
Next slide.

Okay.
Priorities.
Just in case I scared you with all the penalty talk and all that stuff, your
first priority for the Urban Challenge is no collisions.
The second one is to complete the mission.
Not to avoid the penalties.
I don't want to see the vehicle frozen because it's afraid to cross the double
yellow, okay?
The vehicle needs to find a way to achieve the mission, even if it has to take a
penalty.

So minimizing penalties is tertiary, it has to do with whether you get caught and -- [LAUGHTER]
Next slide.
Okay.
Rules, that's the end of that section.

What we are going to do now is entertain questions. We have Kristen and I guess Ron went out. There he is right there. Well, obviously I hope those of you who know who you are, even non-traditionals know who you are. So I'm sure you have a lot of questions. We'll try to get through as many as we can. This is prom week around here, so we really have to be out of here at 2:30, or we are going to have a whole bunch of high school kids coming through that door. So we'll just start with questions. If you could, there's microphones so everybody can hear your question.

Audience: I asked Kristen a little bit earlier, what kind of a cost proposal do we submit if the price is fixed and there's essentially no fee?
Presenter: I looked it up in the PIP, and it's addressed at paragraph 3.2.8.3, (laughter) and if you want to know what it says I can read it to you real quick.

Audience: You've got it though, right? This information -- those this were not fortunate enough to come today, how will they be able to see this, I understand it's being recorded. Will this be on a particular channel on a particular day?
Presenter: I guess we are copying it, right, this webcast, and -- Excuse me? Slides and the transcript? Slides and the transcript. Are we keeping the video itself? We'll post the video. Just have to check the file sizes. If it gets to be a terabit we'll have a problem but it will be posted and we'll let you know.

Audience: I have two questions -- here at the back, sorry. I have two questions, one of them is you mentioned that GPS outages. I wanted to know how they would interfere with achieving way points, or would there be GPS outage around way points, and the second question is concerning pedestrians, will there be pedestrians in the final test and how would we protect them?
Presenter: The GPS outages are naturally occurring. Imagine a road with a row of tall trees down one side of it. You'll either lose all GPS or the differential corrections. And there are way points along there, too. INS will have to deal with that. Second question was?

Audience: Second question about pedestrians. Will there be pedestrians?
Presenter: no pedestrians, other than the non-traditionals. (laughter) Robby got my pedestrian question. When you talk about an impassable route, that would be some common definition, like a roadblock? There's a vehicle stopped in front of you that shouldn't stop you from going but it might be impassable, depending on how you interpret it. Will it be something that covers the entire road?
Presenter: If we introduce it, it will be a K rail across. You won't be able to get past it. It's going to cover both lanes.

Audience: RNDF files, two questions.
Is there a sense of how large the area is going to be? Is it going to be tens of roads, hundreds, thousands, millions? And second, you are going to have human-operated vehicles that are going to enter the area. Could the situation occur entering from outside RNDF, we don't know if they have a stop sign or not.
Presenter: First question was the density of -- Repeat the first question. We really did not understand it.

Audience: How many road segments to expect in RNDF, tens, thousands, millions?
Presenter: No, it will be -- it will be larger than the sample, but some small whole number times the sample. Okay. 3, 5. Right.

Audience: And if outside vehicles come, my team worries about if they come from outside, you might not know if they have a stop sign or not. If they come from outside the RNDF, they might not even know if they have a stop sign or not because that's not specified.
Presenter: Outside the RNDF the traffic vehicle will have to worry about entering traffic safely.

Audience: The goal is to cross the checkpoint, right? Can you game the RNDF such that, for example, when I was looking at it, there were several ways to get to different points, doing U-turns on segments of roads that were allowed U-turns. I mean you -- it's not like you are going from point 1, point 2, point 3, point 4, over to, you know, left hand turn. You are really looking to go through the checkpoints. Are we free to game how we get to the checkpoints, as long as we stay in the RNDF?
Presenter: As long as you follow the rules of the road, you can do it. The use of the word game is probably not right.
Audience: Whatever you want to call it. Strategize.
Presenter: You can go between checkpoints as you want to, yeah. I mean we are not going to restrict the way you get there. Other than there will be roadblocks occasionally. The whole U-turn and traffic situation, we may look at that. Yeah. So rules of the road would be a little bit more clear. You are allowed to take any legal path from one checkpoint to the next.
Audience: Left hand turns, legal or illegal? Will we be going across double yellow lines or no?
Presenter: You can cross -- we spec a double yellow line in a segment, you know, in a real segment it has a gap there. We didn't tell you about the gap in the double yellow.
Audience: Will the gap be physically there or not?
Presenter: Not physically there but you'll still be able to make the left turn.

Audience: Will we have to pass slow moving vehicles or just stopped vehicles?
Presenter: Slow moving vehicles.

Audience: We have to pass slow moving vehicles as well?
Presenter: The question is, do you have to pass them, you don't have to pass them. But there will be an area with a broken white line, which is passing, and you'll be able to pass a vehicle there.
Audience: Thank you.

Presenter: Audience: Just to follow up on that. In passing a moving vehicle, there will be two lanes of traffic traveling the same direction so you are not passing into oncoming?
Presenter: That's correct.

Audience: With regard to the site visit, I realize you said you were going to put out some more information. But can you give us any head's up with regards to the requirements, the physical area, the acreage of whatever needed, how many parallel lanes, what kind of surface texture of pavement, or do we have to have lane markings, things of that sort? The general idea will be two-lane roads, paved roads, you know, with lines down the middle. We need both lanes there, that's critical. I need two lanes. And roughly between 250 and 1,000 meters. Some kind of Manhattan geometry would be helpful. If you had a city block or two, that would be just perfect. Just perfect? (laughter)

Audience: What about -- what about existing government-funded projects, say, for instance, DARPA, Logger,sharing algorithms, resources, people between that and the Grand Challenge?
Presenter: Those are all separate things. You can certainly share algorithms. But if you take Larry's funding and use it on the Grand Challenge we may need to have a discussion about that.

Audience: Well we don't have it yet [LAUGHTER] That mostly answers my question. The other question I had is regarding way points, if you miss, if the robot thinks it made the way point but is judged to have missed it, does that mean the mission fails, or is it just a penalty?
Presenter: We'll probably ding you for that but you will continue to run the race.

Audience: Are there expected to be any small obstacles on the lane that you need to avoid but still stay in the lane or is just being in the center of the lane sufficient? Like a cone on the side of the lane that you need to swerve around?
Presenter: If there was a cone there you would be expected to swerve around it. We have not speced it in any of the documents saying you have to avoid cones.
Audience: Are you sure that we will have those things there?
Presenter: The key obstacles are things that are bigger than a cone -- traffic barrel, other vehicles.
Audience: No obstacles which partially block the road?
Presenter: It could, it could.

Audience: In track A does using FAR give somebody a special advantage or is the FAR in the other same on the other track?
Presenter: You can use whichever type of contract vehicles suits your preference best. There will be no preference given. Track A and track B, you can try for track A, and if you fail, for whatever reason, you can always back off to track B. that's one reason why we created track B.
Audience: I understand. I meant within track A itself.
Presenter: I don't think there's any advantage in that.
Audience: Two questions. Will roadblocks be permanent for the duration of the final event, like if it is blocked at one point will it always be blocked? And do you have to drive on the right-hand side in a parking lot where there is really no lanes defined?
Presenter: for the first answer I would not assume that obstacles is there or the configuration is the same. Second question is about parking lots?
Audience: Yeah, do you have to follow the implied rules of the road, drive to the right-hand side and things like that.
Presenter: There is not a requirement to do that.
Audience: Okay.Great.
Presenter: As long as you don't hit anything.
Audience: Right. Another
Audience: I had a question about U-turn across a double yellow line. If the vehicle encounters a blocked segment of road and it has to turn around, if it's following the rules of the road or the California driving rules or whatever was stated in the preliminary rules, it may have a preference not to go across a double yellow line, especially make a U-turn across a double yellow line. But if it's a bot segment it would have to do that on the fly. That would be at the risk of an infraction?
Presenter: You know, it's a funny thing about that. We called up the California High Patrol and said "you know in the laws you can't cross a double yellow, what happens if the lane is blocked? They laughed. They said of course, cross the

double yellow and keep going. It's just what you would do that the vehicle needs to do.

Audience: I am wondering if the terrain will be relatively flat. Do we need to worry about limited visibility because of hills and having a vehicle stop on a hill and having to restart.

Presenter: I think the trees and buildings will be more the visibility problems.

Audience: I have a question about base platforms. The rules are fairly lenient on the upper side. What if you have a platform you think would be relevant that's, you know, 1996 pounds. And not 2,000 pounds.

Presenter: Just add some weight.

Presenter: Add some weight. (laughter) Add some weight.

Audience: How many track A proposals do you envision funding or alternatively what's your total budget for track A?

Presenter: We won't fund more than ten.

Audience Ten?

Presenter: Yeah. We are not guaranteeing ten either, but not fund more than ten.

Audience: Thank you.

Audience: I was wondering if you could enter what the whether will be like, during the day or night, can we expect inclement weather at all? Will it be postponed if there is too good a snow?

Presenter: In November, western part of the United States, maybe not the western part of the United States, we are negotiating here. I don't think you need to worry about weather.

Audience: Okay. Thank you.

Presenter: I hope you don't need to worry about weather. There will be weather.
[LAUGHTER]

Audience: In the comments about the contracts earlier, and I thought this applied to the other part of track A, it said you had to have an authorized contracting officer sign the document or something before you could start. Did I hear that right?

Presenter: That's Kristen, she always reminds all of us she's the only one who is really in control. [LAUGHTER] And all of that, all of that was just her saying that, right? Kristen: That's right. It's good to be clean.

Presenter: So that's all that means is that you need to have a contracting officer. Don't -- if Norm comes up to you and says hey, do this, in other words you are in track A, okay? Do this and do that, and it's not part of your proposal, it's like extra, well, she's the one that you really want to get to say yeah, what he said is okay. Kristen: Particularly if you expect to get paid for it

Presenter: Yeah. If you don't want to get paid for it, it's okay.

Audience: My question is also a contracting question. Can volunteer labor count as a cost share in any way?

Presenter: We haven't thought about that. Kristen, yeah. We haven't thought about that. And traditionally the government is not authorized to accept volunteer labor.

Presenter: I'm not sure. We need to think about that. It's a labor that's not being paid, I guess. It depends on how you can -- well, I guess we need to think about that.

Audience: My other quick question concerns liability insurance. I think it's going to be really, really difficult to obtain. And if it's necessary to have someone sitting in the car during the site visit for liability insurance purposes, would that be okay?

Presenter: We are not going to let anyone sit in the vehicle during the site visit.

Audience: I have questions in terms of the entering a team with two vehicles, multiple vehicles. Does the rule allow in a situation, you have a collision but it's not your fault, to swap the vehicle and enter the race?
Presenter: I don't think so. I think once you got your car out on the track, it's there. So pick the right car. (laughter) You can use the parts, I'm sorry. My wife says you can use the parts from the car that's not crashed.

Audience: Just one clarification on the weight question. It's the weight as delivered by the manufacture of the vehicle that counts, and any customizations the manufacture has done it's okay?
Presenter: The weight with the full tank of gas as delivered by the manufacturer.
Audience: As delivered by the manufacturer to you.
Presenter: That's right.

Audience: I have a question regarding the multiple cars at an intersection. Would that, if the cars are stopped, determined by the first car stopped and then goes counterclockwise to the left? The car, the subsequent cars that can go?
Presenter: What are the rules in California? Precedence order, the first to arrive is first to leave. And you know, there's a simultaneous arrival with one to the right gets precedence -- I don't know what simultaneous arrival means to the robot.
Audience I guess one would determine, robot A would determine B was there first, and – B would determine that A was there first.
Presenter: One may interpret it as simultaneous arrival and the other may not. You could be in a situation where both may want precedence and neither one takes precedence. That's what the taxi cab rules are all about.
That's when the taxi cab rules take over. If both are in the intersection, one of the rules of the intersection is it's always a check and go situation. You are monitoring very carefully when you go through.
Audience: No blinking the headlights saying okay, you can go? [LAUGHTER]
Presenter: That will get you in the news reel.

Audience: Very quick question about the third or fourth slide you had up there. You had lines across the intersection to show where they should stop on the bottom and the right-hand side, and then striped lines on the left and top. Is there any -- and it's more fodder for thought. Will there be a standard stop line throughout the entire route, or will some be solid lines, some of them dashed?
Presenter: You know what, I don't completely know.
We have to release that to tell you what they look like.
Audience: We are driving around now filming and it may turn out that that's incorrect because of the way you line it up. So that's just to help us all out, that would be great. Thank you.
Presenter: Okay. Over here.

Audience: In order to preserve that prize money should we all be going home and writing our senators?
Presenter: You have to do what you have to do. [LAUGHTER] I -- I can't recommend anything.

Audience: A couple of questions. First question about the track A. Can you -- is it possible to divide the track A money and the money you might spend on your own, and how is that going to affect the intellectual property rights? I mean -- is it, do we have to show where we spend this money, how much we develop using

track A money that we got from DARPA, and that's the IP that needs to be transferred, or how does it work?

Presenter: I think you want to explain what you really mean by government purpose rights. It's not a big deal. All we are asking for is basically a fully paid-up license. So later on if you are successful and want to sell it to the government, you can't charge us a royalty again.

Audience: Okay. I see.

Presenter: That's really – at the bottom of the day, all we are getting is a fully paid-up license.

Audience: Second question was –

Presenter: she may disagree, but that's what I think, anyway.

Audience: My second question was, you mentioned that you let commercial production vehicles into the race and, but you also briefly mentioned that military vehicles might be allowed, and so is there a restriction on what kind of platforms you can use, apart from the specifications that you provided?

Presenter: If you have a true military vehicle, that's when all those ITAR problems are going to start to pop up. If you are a defense contractor, so there's a limitation there in which you can do. Other than that, we require rubber tires.

Audience: Do you require a safety record or safety -- you know that you should have a track saying whether you can avoid -- whether you have successfully shown that you've been able to avoid collisions. Will that be part of?

Presenter: That's an or, that's an or.
If you have a vehicle that's not, you know, a Ford pickup truck, and you want us to consider it, and it is something that has been used in a road race across the world and has a documented safety record, that's good evidence that you would consider that vehicle. If it is something you made in the back yard and have not tested yet, that's weaker evidence. No tracked vehicles I think is another rule.

Audience: My question has to do with street legality, or licensing. Does our vehicle have to be street legal? is the first question. And then the other question is do we have to license it or should it be licensed like in the state?

Presenter: Let me answer that. We actually went into that. There is some question as to some of these vehicles whether it would be truly street legal with all the autonomous stuff on it, it's a complicated term. Because it's a fuzzy term we don't use it. There isn't a requirement it needs to be licensed with a license plate. We'll be operating in an area not open to the public.

Audience: Okay. Just one other question is GPS way point accuracy, what degree of accuracy or precision do we have on our GPS coordinates on that?

Presenter: Its in the rules. I think six figures to the right of the decimal.

Audience: And that is military precise accurace GPS, right?

Presenter: The unit we use is 15 centimeter, one sigma is the spec. We take multiple readings -- if you look, the accuracy varies at different times. So it can actually be larger, depending what the satellite configuration is.

Audience: You mentioned three ways to qualify for the OT. Do we have to do all three or is it an or?

Presenter: It's an or.
You know what, Kristen, you never really did say what a non-traditional was, why don't you give that definition. Kristen: a non-traditional defense contractor is someone who has not had a contract for a prototype or other R & D in excess of 500,000 in the last year. Prenter: So if you have never had a contract with the government you are by definition a non-traditional. I see, over here, I guess.

Audience: I am wondering about a track A proposal. What would be the impact of having or not having an existing autonomous vehicle at the time you are making the proposal?

Presenter: Well, it won't help. If everybody doesn't have one, then it doesn't matter. But it won't help you not to have one.

Audience: Okay. noticed new language to make it harder for single teams to submit vehicles.

But there is a gray zone, I think, in the end. Therefore my question, if two teams have separate people, for example, decide to share the software, or share significant parts of the software, would that then disqualify them?

Presenter: Well, as far as selection goes, for example, in track A, we are looking for distinct technical solutions.

Audience: Does that mean they can't share a fusion algorithm, no, they can do it. We don't want two teams coming together with one technology and entering that twice. We want different vehicle solutions and different software solutions for each entry. For the fellow that asked the last question. I don't want you to think if you don't have a vehicle you can't go on track A. But what you will have to do on your proposal on track A, is show the plan for doing that. So you don't really need to have it in track A but you do need to have a good explanation of how you will get it. And that will be evaluated. Obviously better if you have one, but you don't really need one. As long as you have a good plan. Let's see who is out there.

Audience: As a Ford employee, I would like to thank you for using Ford pickups as the example every time. Our Ford pickup drives in reverse as well as forward. You showed a network diagram with three possible routes to a way point, two which were blocked.

Is it legal possibility to back up to the intersection and proceed, or do you have to do a three-point turn? What was your intention there?

Presenter: Our intention was the three-point turn and long backups down the streets were discouraged.

Audience: okay so you can't drive fast in reverse.

Presenter: Reverse is required and you have to have sensors in the back because ever the advanced navigation testing, backing up in the parking lot.

Audience: Obviously.

But you can't go -- let's say the blockage was 100 meters down the street, you could not just back up 100 meters.

Presenter: Let me put it this way. You need to achieve your mission. That's your first goal. Three-point turns are preferred because traffic may be coming. I hear the chief judge is a pretty good guy, actually. Go ahead.

Audience: Is all your paint going to be reflective and is there going to be reflectors on your K rails?

Presenter: If that's a suggestion, we'll take that suggestion. (laughter)

Audience: I actually have two questions.

Is there going to be a situation where moving vehicle in front of you is going to stop, you have to know to go around it, or a stop sign with a whole line of cars, you have to know to ..

Presenter: There may be situations where there's a stop sign and a line of cars at the stop sign. Your vehicle has to figure out if there's a vehicle in front of you or a line of vehicles at a stop sign.

Audience: And the waypoints, how are they marked, is there going to be like paint?

Presenter: Waypoints are not marked. Checkpoints are Marked for people to see. The vehicle needs to know where the checkpoint is. We are starting to run out of time. Let's take, how about up here.

Audience: So there seems to be a little conflict with the separation between vehicles. So there's a 15 meter gap to 40 meter gap when you are traveling at 15 miles an hour, and 5 meter gap when you are stopped. It seems like there is something where you want a function based on travel speed as opposed to discreet speed?
Presenter: We'll take that as a suggestion.

Audience: Will there be any feedback presented for the site visit for proposal teams that don't get selected?
Presenter: Sure, absolutely.
Audience: Like last time -- I think last time there was nothing.
Presenter No, I don't think there was. There was no feedback last time. Not that there was any deliberate reason why not, we just didn't have the people to do it. If you are not selected and you want feedback, then ask us and we'll try, we'll try to give you feedback. On A track it's automatic.
Audience: It appeared from the presentation that there may not be road signs, or the vehicles will not be required to recognize the road signs. Is that correct?
Presenter: That's correct.
Audience: Okay. So they'll basically be given in the data file.
Presenter: Yep. They're in there. Okay. Maybe two more here and I think that's about it. You two.

Audience: In areas where there will be sparse way points where you have to do road following, will there be lane markings on those roads?
Will there be curbings on the roads?
Presenter: It's not a guarantee.
There will be roads that may have lane markings or may not. They could be dirt roads. It's, you know, it's an urban area.

Audience: I just want to drill down on the back-up vehicle for a minute. It mentions the rules, I believe it's the rules, there's a back-up vehicle for the NQE. Can that be used if you are a victim and your vehicle is determined to not be able to be repaired in the time required?
Presenter: The answer is yes. What we agreed, if you can integrate the E stop, we'll give you an E stop test. The vehicle crashed up the NQE perhaps through no fault of its own, the same software because this is really a software race, we'll let you run the software on a different platform.
Audience: Thank you. That's it. We are out of time. Thank you very much. See you in November.